

31. New Mexico, 12. New York, 3, 4, 11, 17, 27, 28, 30. North Carolina, 2 to 5, 14, 17 to 20, 22, 23, 24, 26, 29. North Dakota, 2, 4 to 11, 15, 16, 18, 24, 26, 27, 28, 29. Ohio, 2, 3, 5, 11 to 14, 18, 19, 21, 25, 26, 28, 30. Oklahoma, 13, 16, 21, 27, 28. Oregon, 1 to 5, 8, 9, 11, 12, 14, 16, 17, 20, 21, 22. Pennsylvania, 5, 14, 15, 18, 26, 30. South Carolina, 1, 3, 17, 18, 21, 26, 28. South Dakota, 2, 7, 11, 16, 23, 24. Tennessee, 2, 17, 19, 22, 26, 27, 28, 31. Texas, 1 to 4, 8, 9, 10, 12, 13, 21, 27, 30. Utah, 5, 10, 11, 15, 19, 29. Vermont, 30. Virginia, 12, 13, 18, 19, 22, 26. Washington, 1 to 5, 8, 10 to 16. West Virginia, 12, 13, 14, 18, 24, 25, 26, 29. Wisconsin, 1, 12, 13, 14, 24, 25, 26, 29, 30.

## SLEET.

The following are the dates on which sleet fell in the respective States:

California, 7. Montana, 5, 14, 17, 18, 19. Nevada, 9, 11, 15. Oregon, 1, 2. Washington, 2, 13, 16.

## WIND.

The prevailing winds for May, 1896, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The resultant winds, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

## HIGH WINDS.

Maximum wind velocities of 50 miles or more per hour were reported during this month at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				Miles	
Amarillo, Tex.	8	60	s.	Moorhead, Minn.	12	63	se.
Buffalo, N. Y.	28	52	sw.	New York, N. Y.	18	52	w.
Do.	29	53	w.	Do.	19	52	sw.
Cairo, Ill.	26	60	nw.	North Platte, Nebr.	6	55	se.
Cheyenne, Wyo.	11	52	w.	Port Huron, Mich.	17	54	sw.
Do.	25	50	w.	Do.	28	54	sw.
Chicago, Ill.	14	60	s.	St. Louis, Mo.	27	80	nw.
Do.	17	58	sw.	San Antonio, Tex.	2	60	nw.
Do.	25	62	s.	Springfield, Ill.	26	60	nw.
Cleveland, Ohio	28	50	w.	Tatoosh Island, Wash.	8	52	ne.
Davenport, Iowa	16	60	nw.	Washington, D. C.	19	56	nw.
El Paso, Tex.	12	52	nw.	Do.	28	54	sw.
Do.	29	53	sw.	Williston, N. Dak.	2	60	nw.
Huron, S. Dak.	7	51	se.	Do.	10	60	se.
Do.	9	52	s.	Winnemucca, Nev.	22	55	s.
Marquette, Mich.	25	52	se.	Do.	29	50	sw.

## SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 17 regular stations of the Weather Bureau by its photographic, and at 21 by its thermal effects. At one station records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric sheets show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine, but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

## COMPARISON OF DURATIONS AND AREAS.

The details are shown in the following table, in which the stations are arranged according to the greatest possible duration of sunshine, and not according to the observed duration as heretofore.

## Difference between instrumental and personal observations of sunshine.

Stations.	Apparatus.	Total possible duration for the whole month.	Personal estimated area of clear sky.	Instrumental record of sunshine.			
				Photographic.	Difference.	Thermometric.	Difference.
		Hrs.	%	%	±	%	±
Bismarck, N. Dak.	P.	467.4	46	49	+ 3	.....	.....
Helena, Mont.	P.	467.4	44	49	+ 5	.....	.....
Portland, Oreg.*	P.	464.1	43	34	- 9	.....	.....
Eastport, Me.	T.	464.1	43	.....	.....	34	- 9
Northfield, Vt.	P.	460.7	43	60	+ 17	.....	.....
Portland, Me.†	P.	457.9	42	52	+ 10	.....	.....
Buffalo, N. Y.†	T.	454.9	46	.....	.....	56	+ 13
Rochester, N. Y.	T.	454.7	69	.....	.....	87	+ 18
Boston, Mass.	T.	451.9	46	.....	.....	58	+ 12
Chicago, Ill.	T.	451.9	66	.....	.....	78	+ 12
Cleveland, Ohio	P.	451.9	52	61	+ 9	.....	.....
Des Moines, Iowa.	P.	451.9	34	.....	.....	62	+ 28
Detroit, Mich.	T.	451.9	63	.....	.....	79	+ 16
Eureka, Cal.	P.	449.1	47	53	+ 6	.....	.....
New York, N. Y.	T.	449.1	46	.....	.....	49	+ 3
Salt Lake City, Utah.	P.	449.1	26	53	+ 27	.....	.....
Columbus, Ohio	T.	446.7	43	.....	.....	57	+ 14
Denver, Colo.	T.	446.7	50	58	+ 8	.....	.....
Philadelphia, Pa.	T.	446.7	36	.....	.....	64	+ 28
Baltimore, Md.	T.	443.8	34	.....	.....	32	- 2
Cincinnati, Ohio	T.	443.8	58	.....	.....	80	+ 24
Kansas City, Mo.	P.	443.8	40	52	+ 12	.....	.....
St. Louis, Mo.	P.	443.8	55	.....	.....	74	+ 19
Washington, D. C.	P.	443.8	40	45	+ 5	.....	.....
Dodge City, Kans.	P.	441.7	58	63	+ 5	.....	.....
Louisville, Ky.	T.	441.7	52	.....	.....	74	+ 22
San Francisco, Cal.	T.	441.7	62	.....	.....	68	+ 1
Santa Fe, N. Mex.	P.	436.7	64	81	+ 17	.....	.....
Little Rock, Ark.	T.	434.2	61	.....	.....	79	+ 18
Atlanta, Ga.	T.	432.6	53	.....	.....	86	+ 23
Wilmington, N. C.	T.	432.6	55	.....	.....	71	+ 16
Phoenix, Ariz.	P.	430.7	80	89	+ 9	.....	.....
San Diego, Cal.	P.	430.7	65	74	+ 9	.....	.....
Savannah, Ga.	P.	428.4	59	73	+ 14	.....	.....
Vicksburg, Miss.	T.	428.4	73	.....	.....	77	+ 5
New Orleans, La.	T.	423.7	64	.....	.....	67	+ 3
Galveston, Tex.	P.	421.8	67	74	+ 7	.....	.....

\* Records by both methods. † Records for only 22 days, for which the total possible duration of sunshine was 322.9 hours. ‡ Records for 25 days; total possible, 364.5 hours.

The sunshine registers give the durations of effective sunshine whence the duration relative to possible sunshine is derived;

the observer's personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for May, 1896, is 8 per cent for photographic and 14 per cent for thermometric records.

#### ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table X, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

**Thunderstorms.**—The dates on which reports of thunderstorms for the whole country were most numerous were: 11th, 237; 12th, 237; 13th, 223; 18th, 233; 19th, 256; 26th, 258; 28th, 254.

Thunderstorm reports were most numerous in: Illinois, 326; Iowa, 219; Missouri, 470; North Carolina, 245; Ohio, 345.

Thunderstorms were most frequent in: Kansas, 28 days; Nebraska and North Carolina, 27; Missouri and South Carolina, 26; Arkansas, Minnesota, and Ohio, 25.

**Auroras.**—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 22d to the 30th, inclusive. On the remaining twenty-two days of this month 203 reports were received, or an average of about 9 per day. The dates on which the number of reports especially exceeded this average were: 2d, 78; 3d, 19; 17th, 57; 18th, 17.

Auroras were reported by a large percentage of observers in: New Hampshire, 43; New York, 24; Minnesota, 30; Wisconsin, 78.

Auroras were reported most frequently in: Wisconsin, 10 days; Minnesota, 9; Iowa, 8; North Dakota and New Hampshire, 7; Michigan, 6.

#### CANADIAN REPORTS.

Thunderstorms were reported as follows: 1st, Saugeen;

2d, Toronto, Port Stanley; 3d, Rockcliffe, Port Stanley; 4th, Port Stanley, Saugeen, Swift Current; 5th, Yarmouth; 6th, Minnedosa, Qu'Appelle, Prince Albert; 8th, Winnipeg; 9th, Winnipeg, Minnedosa; 10th, Grand Manan, St. Andrews, Rockcliffe; 11th, Grand Manan, Port Stanley, Winnipeg, Qu'Appelle, Swift Current; 12th, Charlottetown, Port Stanley, Minnedosa; 14th, Port Stanley; 15th, Toronto, Saugeen, Port Stanley; 16th, Swift Current; 17th, Rockcliffe, Toronto, Port Stanley; 18th, Grindstone, Halifax, Yarmouth, Toronto; 19th, Port Stanley; 21st, Swift Current; 22d, Halifax, St. Andrews, Quebec, Swift Current; 23d, Minnedosa, Swift Current; 24th, Minnedosa; 25th, Toronto, Port Stanley, Saugeen, Parry Sound; 26th, Quebec, Port Stanley; 27th, Yarmouth, Saugeen; 28th, Toronto, Port Stanley; 29th, Halifax, Minnedosa, Swift Current; 31st, Yarmouth.

Auroras were reported as follows: 1st, Quebec; 2d, Halifax, Yarmouth, Charlottetown, Quebec, Montreal, Winnipeg; 3d, Father Point, Quebec, Port Arthur, Minnedosa, Battleford; 4th, Father Point, Winnipeg; 6th, Quebec, Winnipeg; 7th, Port Arthur, Winnipeg; 11th, Father Point, Quebec; 14th, Quebec; 15th, Father Point; 16th, Port Arthur, Montreal; 17th, St. Johns, Halifax, Yarmouth, Quebec, Montreal, Toronto; 18th, Quebec, Montreal, Winnipeg, Battleford; 19th, Quebec, Port Arthur; 20th, Grindstone, Prince Albert; 21st, Prince Albert; 22d, Prince Albert; 23d, Father Point.

#### INLAND NAVIGATION.

The *extreme and average stages of water* in the rivers during the current month are given in Table VIII, from which it appears that the only river which attained the danger line was the Mississippi, at La Crosse, Wis., which reached 10.7 on the 24th and 25th. But in consequence of the heavy rains in the lower Missouri watershed numerous small streams overflowed, especially in Kansas, Iowa, Illinois, and Missouri, and the Mississippi rose steadily up to the close of the month at all stations between St. Louis and Vicksburg.

#### METEOROLOGY AND MAGNETISM.

By Prof. FRANK H. BIGELOW.

The values of H given in the table of Chart V are to be added to 0.18250, those of D to 180', these numbers being the means for Toronto and Washington. A strong disturbance of the magnetic field occurred from May 2 to May 4, but did not effect the other elements. The circulation of the atmosphere was very stagnant from May 1 to May 13. A severe storm then occurred in the Lake Region, May 15 to May 17. A brisk eastward movement in the northern circuit set in about May 18, and continued to the end of the month.

### CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

**Alabama.**—The mean temperature was 75.8°, or 2.5° above normal; the highest was 100°, at Tuscaloosa on the 25th, Pineapple on the 26th, and Union on the 31st; the lowest was 49°, at Valley Head on the 30th. The average precipitation was 3.44, or 0.51 below the normal; the greatest monthly amount, 6.32, occurred at Bermuda, and the least, 1.18, at Union.

**Arizona.**—The mean temperature was 72.4°, or 3.5° above normal; the highest was 117°, at Parker on the 26th and at Fort Mohave on the 27th, and the lowest, 22°, at Flagstaff on the 21st. The average precipitation was "trace," or 0.32 below normal; "trace" was the greatest amount recorded anywhere, and was reported from 16 stations, while no precipitation occurred at numerous other stations.

**Arkansas.**—The mean temperature was 74.4°, or 5.4° above normal,

and is the highest during the past fourteen years; the highest was 98°, at Helena on the 8th and at Camden on the 31st, and the lowest, 46°, at Keesees Ferry on the 2d. The average precipitation was 3.54, or 1.34 less than normal; the greatest monthly amount was 8.35, at Moss-ville, and the least, 0.76, at Luna Landing.

**California.**—The mean temperature was 61.2°, or 2.9° below normal; the highest was 124°, at Salton, in the desert regions, on the 27th, and lowest, 12°, at Bodie, in the high mountain regions, on the 10th. The average precipitation was 1.36, or 0.50 above normal; the greatest monthly amount, 10.03, occurred at Bear Valley, while none fell at numerous points.

**Colorado.**—The month was warmer than usual in all sections, except the extreme northwestern part of the State, where it was slightly cooler. The highest temperature was 100°, at Minneapolis on the 29th and at Delta on the 30th; the lowest, 10° below zero, occurred at Climax on the 14th. The average precipitation was 1.15, or 1.08 below normal; the greatest monthly amount was 5.60, at Longmont; no precipitation occurred at Saguache and only a "trace" at La Jara.

**Florida.**—The mean temperature was 74.7°, or 1.4° below normal; the